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Movements of Atlantic cod (*Gadus morhua*) in NAFO Subdiv. 3Ps and updated estimates of exploitation from tagging experiments in 1997-2002

Déplacements de la morue (*Gadus morhua*) dans la sous-division 3Ps de l'OPANO et estimations mises à jour de l'exploitation d'après des expériences d'étiquetage de poissons effectuées de 1997 à 2002

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Abstract

A tagging study of Atlantic cod (*Gadus morhua*), initiated in 3Ps in spring 1997 was continued with an additional 8,263 tagged fish released during 2002. In this study, a total of 52,500 live cod tagged with single, double, or high-reward t-bar anchor tags has now been released at various inshore and offshore locations off the south coast of Newfoundland. Approximately 8,400 tagged cod have been reported as recaptured up to September 2002. Tag returns were adjusted to account for region-specific reporting rates, and the number of tagged cod available for capture was adjusted to account for tagging mortality, tag loss and assumed natural mortality. These data were used to estimate exploitation annually for each batch of tagged cod. The spatial distribution of recaptures from tagging in each area was summarized each year with numbers recaptured adjusted to account for region-specific reporting rates. The stock appears to comprise several offshore components, as well as resident inshore components in Fortune Bay and Placentia Bay, with limited mixing between them. Portions of the offshore components migrate to the inshore and mix with inshore cod during summer and fall. As in previous years, exploitation estimated from tag returns differed markedly across the stock area. Among cod tagged in Fortune Bay, mean annual estimates of exploitation have been reasonably consistent, ranging from 0.14 to 0.16 during 1998-2001. Among cod tagged in Placentia Bay, exploitation estimates have ranged from 0.11 to 0.23 with highest values during 1999 and a mean of 0.18 for 2001. Estimates of exploitation in 2001 for cod tagged in Placentia Bay are generally lower than those observed in 1999 and 2000, although 5 of 21 estimates still exceed 20%. Among cod tagged in the Burgeo Bank-Hermitage Channel area (3Psd), estimates of exploitation have been low, ranging from 0.04 to 0.08 during 1998-2001. Cod tagged in Halibut Channel (3Psh) have consistently shown lowest mean annual estimates of exploitation (0.02 to 0.03), in spite of substantial offshore landings. More extensive spatial and temporal tagging coverage of the offshore unit areas 3Pse and 3Psh (St. Pierre Bank and Halibut Channel) may be required to improve the reliability of the exploitation estimates for these offshore regions.

Résumé

Une étude d'étiquetage de morues (*Gadus morhua*), entreprise au printemps de 1997 dans la subdivision 3Ps s'est poursuivie par le lâcher de 8263 poissons étiquetés additionnels en 2002. Au total 52 500 morues vivantes marquées d'étiquettes à ancrage en T simples ou doubles à taux élevé de récupération ont jusqu'à maintenant été relâchées en divers emplacements prés du littoral ou au large de la côte méridionale de Terre-Neuve dans le cadre de cette étude. En septembre 2002 on avait signalé la recapture d'environ 8400 morues étiquetées. Les nombres d'étiquettes retournées ont été compensés de manière à tenir compte des taux spécifiques de retour pour chaque région et les nombres de morues étiquetées disponibles pour la capture ont été compensés de manière à tenir compte des taux de mortalité à l'étiquetage, des pertes d'étiquettes et du taux de mortalité naturel supposé. Ces données ont été utilisées pour estimer l'exploitation annuelle pour chaque lot de morues étiquetées. La répartition spatiale des recaptures de morues étiquetées dans chaque zone a été résumée chaque année d'après les nombres de recaptures compensés de manière à tenir compte des taux signalés spécifiques à chaque région. Le stock semble constitué de plusieurs composantes au large ainsi que de composantes littorales résidentes dans la baie Fortune et la baie Placentia, et il semble n'y avoir qu'un mélange limité entre ces composantes. Des parties des composantes au large migrent vers le littoral et se mélangent aux morues du littoral pendant l'été et l'automne. Comme par les années passées, l'exploitation estimée d'après les étiquettes retournées présente des différences marquées sur la région occupée par le stock. Pour les morues étiquetées dans la baie Fortune, les estimations annuelles moyennes de l'exploitation ont été raisonnablement uniformes, variant de 0,14 à 0,16 de 1998 à 2001. Pour les morues étiquetées dans la baie Placentia, les estimations de l'exploitation ont varié de 0,11 à 0,23, les valeurs les plus élevées ayant été observées en 1999 et une valeur moyenne de 0,18 a été obtenue pour 2001. Les estimations de l'exploitation en 2001 pour les morues étiquetées dans la baie Placentia sont généralement inférieures à celles observées en 1999 et 2000, bien que 5 des 21 estimations dépassent encore les 20 %. Pour les morues étiquetées dans la région du banc Burgeo et du chenal Hermitage (3Psd), les estimations de l'exploitation ont été faibles de 1998 à 2001, variant de 0,04 à 0,08. Les estimations annuelles moyennes de l'exploitation des morues étiquetées dans le chenal du Flétan (3Psh) ont été les plus faibles observées (0,02 à 0,03), malgré de substantielles prises au large. Des couvertures spatiale et temporelle d'étiquetage plus étendues des unités au large 3Pse et 3Psh (banc de Saint-Pierre et chenal du Flétan) pourraient s'avérer nécessaires afin d'améliorer la fiabilité des estimations de l'exploitation dans ces régions au large.

Introduction

A mark-recapture study of Atlantic cod (*Gadus morhua*), initiated in NAFO Subdiv. 3Ps during 1997, was continued during 2002. The purpose of the study was to provide information on movement patterns of cod with as well as obtain estimates of exploitation rates on different components of the stock.

Annual estimates of exploitation are given for each tagging experiment conducted in 3Ps during 1997-2002 using the methods described in Brattey et al. (2001a, 2002). This document also gives a summary of the spatial and temporal distribution of recaptures of tagged cod released in various regions of Subdiv. 3Ps during 1997-2002 and reported as recaptured up to the end of September 2002. Previous results from post-moratorium cod tagging studies in 3Ps and adjacent areas are reported in Lawson et al. (1998), Brattey (1999, 2000), Brattey et al. (1999, 2002), Robichaud and Rose (2001, 2002). Historical cod tagging studies (prior to 1994) in the Newfoundland Region are summarized in Taggart et al. (1995), Myers et al. (1996, 1997). Further analyses of the data from the post-moratorium cod tagging experiments are presented elsewhere (Cadigan and Brattey 1999a, b; 2000a, b; 2001, 2002; Lawson and Rose 2000; Lilly et al. 2001; Pope and Brattey 2001).

Materials and Methods

Cod for tagging were captured with various gears (mostly hand-line in the inshore and otter trawl in the offshore), measured (nearest cm) and tagged with one or two t-bar anchor tags inserted at the base of the first dorsal fin, and released. Experienced technicians conducted the tagging. Only cod ≥45 cm (fork length) that appeared healthy were tagged and each batch of cod typically consisted of individuals tagged with either single, double, or high–reward tags. The tags were uniquely numbered and bore a return address as well as the value of the reward ($10 for one single, $20 for two singles, or $100 for high-reward). The tagging program was advertised extensively among those participating in the fishery. Details of the tagging experiments are summarized in Table 1. The number of cod tagged each year ranged from 6,022 in 1997 to 9,770 in 2000. Tagging was conducted mostly in early spring on spawning and pre-spawning aggregations in the following areas: inner Placentia Bay, Halibut Channel, Burgeo Bank-Hermitage Channel, and at three locations in Fortune Bay (Poole's Cove, Pass Island, and off Grand Bank)(Fig. 1). The sizes of tagged cod ranged from 45 to about 115 cm with mean lengths mostly in the 55-65 cm range.

Reported landings of cod from 3Ps during the period 1997 to 2001 and from 3KL during 1998-2001were extracted from the Statistics Branch catch database and are summarized to aid in the interpretation of tag returns (Tables 2A-2C and Fig. 2).

Exploitation estimates

The methods used to estimate exploitation are described in Brattey et al. (2001a, 2002). The number of reported recaptures from individual cod tagging experiments gives minimum estimates of the exploitation (harvest rate) on the aggregations of cod that were tagged. However, in practice, not all fish survive tagging, some tags fall off the fish particularly in the first year, and not all recaptures of tagged fish are reported. Tagged (and untagged) cod also suffer natural mortality due to factors such as predation and disease. Accounting for these losses leads to a reduction in the number of tagged (and untagged) animals available to the fishery. We used information from companion studies to estimate these losses and produce more

realistic annual estimates of exploitation. In this analysis, we estimated exploitation of cod tagged in a specific area at a specific time (i.e. individual tagging experiments), irrespective of where recaptures came from. Only releases (M) in 3Ps in 1997-2002 were used. We did not attempt to estimate population sizes using tag returns and commercial catches in this analysis, because typically some harvesting occurs in an area different from where fish were tagged; this makes it difficult to convert local catches to local population biomass. Analyses of the tagging data that include methods to estimate inshore cod biomass are presented elsewhere (Lilly et al. 2001; Pope and Brattey 2001; Cadigan and Brattey 2001, 2002).

We estimated tag-induced mortality (ϑ) by retaining tagged cod in submersible cages for periods of 5-10 days and monitoring their survival (Brattey and Cadigan 2001). An estimate of 0.13 was obtained from these studies and this value was used for all experiments (i.e. $1-\vartheta=0.87$ survived tagging).

Our method of estimating reporting rate (δ) is based on a high-reward tagging study, described in detail in Cadigan and Brattey (1999a, 2000b) and updated with recent recaptures. We used region-specific estimates of reporting rate calculated from the high-reward tagging study; high-reward tags (k=3) were assumed to have a reporting rate of 1.0.

Tag loss rates were estimated from a double-tagging study (see Cadigan and Brattey 1999a) that showed that tag loss mostly occurred in the first 3-4 months after release with only minimal losses thereafter. For simplicity, we assumed that tag loss ($<$) occurred only in the year of release (y_0) and was negligible thereafter, as shown by Cadigan and Brattey (1999a). To estimate the rate of tag loss over time, we used a simple proportional tag loss model where the tag loss rate for single and high reward tags was $<=0.8^{(52/diff_y0)}$ and for double tags $<=0.96^{(52/diff_y0)}$, where $diff_y_0$ = the number of weeks between the median date of release of tagged fish and the median recapture date of tagged individuals in the year of release. If there were no recaptures in the year of release then $diff_y_0$ was set to one half the number of weeks between the median week of release and the end of the year.

The instantaneous rate of natural mortality was assumed to be 0.2 per yr, and occurred during $diff_y_0$ in the year of release, and between the median dates of recapture between y_0 and y_1. Note that some tagged fish were released during the fishery and annual exploitation estimates for these releases only account for exploitation during a portion of the year. Assuming that M fish are tagged and released with tags of type k and that tag loss and natural mortality take place between the median date of release and recapture, the exploitation rate in the year of release ($:_0$) is:

$$:_0 = E_k(R_{0k}/\delta_k)/((1-\vartheta)M_k\, e^{-m(diff/52)}<_k{}^{(diff/52)})$$

and in the subsequent years ($:_n$) after release:

$$:_n = E_k(R_{1k}/\delta_k)/((1-:_{n-1})M_k\, e^{-m(diff/52)})$$

For some unit areas several tagging experiments were conducted in successive years and we computed mean annual estimates of exploitation by summing the individual estimates of numbers caught (adjusted by reporting rates) divided by the sum of the individual estimates of numbers available for recapture.

Results

Spatial and temporal distribution of cod landings

The total allowable catches (TAC's) in 3Ps in the post-moratorium period were: 10,000 t in 1997, 20,000 t in 1998, 30,000 t in 1999, an interim TAC of 6,000 t during January-March 2000, 20,000 t during 1 April 2000 to 31 March 2001, and 15,000 t during 1 April 2001- 31 March 2002 and 1 April 2002 to 31 March 2003.

Reported monthly landings by unit area for 2001 are summarized in Table 2A. In 2001, there were substantial landings (>1,000 t) in all unit areas, except 3Psd (343.3 t) which is closed to directed cod fishing from November 15 – April 15, and 3Pse/g (262.1 and 120.2 t, respectively). Overall, the spatial distribution of landings has been broadly similar each year with highest landings (30-50% of the entire TAC) coming from Placentia Bay (3Psc) (Table 2B, Fig. 2). In the offshore, landings have mostly been highest in 3Psh or 3Psf, which includes the southern Halibut Channel and the southeastern portion of St. Pierre Bank. At the beginning of the management year (April and May) inshore landings were low and came mostly from by-catch fisheries. There were substantial landings in all inshore unit areas during June and July 2001, particularly in Placentia Bay with reported landings of over 1,200 t. Inshore landings were slightly lower in August in 3Psa and September-October in 3Psb/c, but tended to increase again in November. As in previous years, there were substantial landings (1,386 t) in Placentia Bay during November. In the offshore, landings tended to be higher in late fall (November-December) and winter (January-March) and low during the spring and summer months (April-August), with Halibut Channel (3Psh) and the southeastern corner of St. Pierre Bank (3Psf) accounting for most of the offshore landings. Preliminary landings for the 2002 calendar year (not shown) show similar spatial and temporal trends to those seen in 2001.

There have been some recoveries of 3Ps-tagged cod in the inshore of 3KL and reported landings for this region from 1998-2001 are summarized by unit area in Table 2C.

Numbers of recaptures

Details of the numbers of tagged cod reported as recaptured annually up to the end of September 2001 are summarized for each tagging experiment in Table 3. There have been substantial numbers of recaptures from most tagging experiments, particularly those conducted in Placentia Bay during spring. Offshore taggings (Halibut Channel, Hermitage Channel, Burgeo Bank, NW St. Pierre Bank) have tended to generate substantially fewer recaptures. Overall, the numbers of returns appears to be tracking the changes in reported landings, with the highest numbers of tag returns in 1999 coinciding with the 30,000 t TAC in that year.

Exploitation estimates

Annual estimates of exploitation for each tagging experiment are summarized and grouped by unit area of release in Table 4. Note that the values may differ slightly from those reported in Brattey et al (2002); this is due to a slight change in the estimated reporting rate and recovery of additional tags from previous years. Values for 2002 for all experiments are preliminary as the fishery was still in progress. Tagging has been conducted at many locations in some unit areas; consequently, there are multiple estimates of exploitation for some areas, notably Placentia Bay (3Psc).

The number of cod tagged has been too low in the western portion of the inshore (i.e. 3Psa) to draw firm conclusions about exploitation of cod tagged in that region. Among cod tagged in Fortune Bay, mean annual estimates of exploitation have been reasonably consistent, ranging from 0.14 to 0.16 during 1998-2001 and estimates have tended to be higher for cod tagged at Poole's Cove compared to Pass Island. Among cod tagged in Placentia Bay, mean annual estimates of exploitation have ranged from 0.11 to 0.23 with highest values during 1999 and 2000 when both the overall TAC and landings in Placentia Bay were highest (see Table 2B). Although mean annual estimates of exploitation in 2001 for cod tagged in Placentia Bay are generally lower than those observed in 1999 and 2000, 5 of the 21 individual estimates for 2001 exceed 20% (Table 4).

Among cod tagged in 3Psd, mean annual estimates of exploitation have been much lower than those for cod tagged in Placentia Bay, ranging from 0.04 to 0.08 during 1998-2001. Cod tagged in Halibut Channel (3Psh) have consistently shown lowest mean annual estimates of exploitation (0.02 to 0.03), in spite of substantial landings, particularly in 2000 (see Table 2B).

Spatial and temporal distribution of recaptures

Annual summaries of the distribution of recaptures, grouped by unit area and year of release, are given in Table 5; the actual number of returns has been adjusted by region-specific reporting rates estimated from the high-reward tagging study (see Cadigan and Brattey 2002). Plots showing the distribution of recaptures (only for tags where exact recapture positions were reported) are shown in Figs. 3-8.

Cod have been tagged offshore in Halibut Channel (3Psh) during April in five consecutive years. (see Fig. 3 and Table 5). Recaptures have come mainly from three areas: (1) the slope edge at the bottom of Halibut Channel close to the area of release (3Psh), (2) shallow water on the south-east corner of St. Pierre Bank in unit areas (3Psf and 3Psh), or (3) inshore in Placentia Bay and around the Avalon Peninsula (3Psc and 3Lj/q/f). Note that no plot is shown for recaptures from the 2002 releases as only two recaptures with known positions were reported up to September 2002. A few have been reported as recaptured in 3NO where the directed fishery for cod is still under moratorium, and single recaptures have been reported from 3K and 4R. Overall, the distribution of recaptures has been consistent, although substantially fewer recaptures have been obtained from the 2000 and 2001 releases in Halibut Channel relative to those released in 1998 and 1999. Also, it is notable that there have consistently been few recaptures from the western portion of the inshore of 3Ps (i.e. 3Psa and 3Psb) in spite of substantial landings.

Cod have been tagged offshore in 3Psd (Hermitage Channel and the southern edge of Burgeo Bank) in April in four of the previous five years (Fig. 4); the exception was 2000 when no significant aggregations were located. Many of these tagged cod have dispersed widely from the tagging area with recaptures extending west and northward into 3Pn-4RS as far north as the Strait of Belle Isle (4Ra) within 3 months of release. Others migrated inshore and eastward along the south coast of Newfoundland into unit areas 3Psa, 3Psb, and 3Psc, and more rarely into southern 3L. The proportion of recaptures from 3Pn4RS relative to 3Ps has varied annually and appears to be higher from the 1998 and 2001 releases (range 34.5-66.7%) compared to the 1999 releases (range 0 to 25.0%). The 2001 and 2002 taggings in 3Psd were conducted somewhat later in April to coincide with the DFO research vessel survey in that area. A substantial proportion of the recaptures from these experiments have come from 3Pn4RS (34.5-61.5%) suggesting that mixing may extend to mid-April in some years; however, the precise

spawning sites and hence stock affinity of these fish remains controversial. Few of the cod tagged in Burgeo Bank have been recaptured on the southeast corner of St. Pierre Bank, or in Halibut Channel, in spite of substantial landings, suggesting little inter-mixing between cod from these two offshore regions of the stock area. The lack of recaptures close to the tagging site in 3Psd can be attributed at least partly to this region being closed to directed cod fishing from November-April in most years.

Most cod tagged near Pass Island and Poole's Cove, Fortune Bay, show strong inshore residency even among recaptures taken 3-4 years later, with most recoveries coming from within Fortune Bay or eastward into neighbouring Placentia Bay (Figs. 4 and 5). There is little evidence of westward movement of these cod; the only exception being among the returns from the 1998 experiment at Poole's Cove; this was conducted later in spring (late May) and could therefore have included some migrant fish from areas to the west (3Pn, 3Psa). Small proportions of cod tagged in Fortune Bay have also been recovered from more distant regions such as southern 3L, offshore 3Ps, and 3Pn4RS, but in general there are no strong indications of any progressive dispersal away from the tagging region over time. Similarly, cod tagged in Placentia Bay (Fig. 7A, 7B) have mostly been recaptured inshore within Placentia Bay. Typically over 80% of the recoveries have come from within Placentia Bay itself, even 4-5 years after tagging (Table 5). In each year, small proportions of recaptures have come from southern 3L, particularly in 1999, and more rarely northern 3L (i.e. 3La, 3Lb) or 3K. Most tagging experiments in Placentia Bay in spring have resulted in a small number of recaptures clustered at the slope edge at the bottom of the Halibut Channel, or scattered across St. Pierre Bank. However, the number of reported offshore recaptures from Placentia Bay taggings has been small in spite of substantial offshore landings (see Table 2B).

Cod tagged on the NW edge of St. Pierre Bank have mostly been recovered only short distances away on St. Pierre Bank, or inshore in Placentia Bay (Fig. 8). There are no recoveries of these cod from 3Pn4RS, in contrast to those tagged in the Burgeo Bank-Hermitage Channel area about 25 miles to the northwest (see Fig. 4).

Discussion

Our cod tagging studies conducted in 3Ps since 1997 give strong evidence of limited mixing, at least among adults, for cod occupying different portions of the 3Ps management area. There are indications of strong inshore residency among fish tagged in spring in Fortune Bay and Placentia Bay. These fish appear to disperse widely along the inshore during summer, particularly in an easterly direction, with their distribution extending well into 3L in some years. There appears to be limited offshore movement of these cod with only a few offshore recaptures even several years after release. These inshore sub-components, particularly in Placentia Bay, are supplemented during late spring, summer, and fall by seasonal migrants from offshore areas. The tagging shows that the inshore catch comprises a mixture of cod that includes inshore fish as well as migratory offshore cod from Burgeo Bank, St. Pierre Bank, and the Halibut Channel. In contrast, the offshore catch (3Ps/e/f/g/h) appears to comprise mainly of fish that reside on St. Pierre Bank and in Halibut Channel throughout the year. Results from tagging in the Burgeo area suggests that there may be mixing of 3Ps cod with those from 3Pn4RS even as late as mid-April, but the extent of mixing appears to vary annually and the precise stock affinity of these fish remains difficult to determine (Campana et al. 1999; Chouinard, 2000; Bérubé and Fréchet 2001). Overall, the movement patterns observed in this study are broadly similar to those described from historical cod tagging conducted in 3Ps (see summaries by

Taggart et al. 1995; Brattey 1996) although these earlier studies did not include inshore tagging in early spring.

Our estimates of exploitation for cod in Placentia Bay during 2001 tend to be higher for recently tagged cod (i.e. 0.18 to 0.27 for cod tagged in 2000 and 2001) compared to those tagged several years ago (0.04 to 0.08 for cod tagged in 1997). We suggest that this may be due to differences in the size (age) composition of tagged cod available for capture relative to the selectivity of gillnets. Cadigan and Brattey (2001) showed using the tagging data that the relative selectivity of gill nets in 3Ps in the post-moratorium period is dome-shaped with a peak selectivity at around 76 cm FL. Average sizes of tagged cod (see Table 1) are generally below the peak selectivity of the gill net fishery in the year of release. However, with further growth in subsequent years these cod would become optimally selected, then be selected less effectively as they grow even larger. This may account for the much lower estimates of exploitation from cod tagged several years ago compared to those tagged in the same area in recent years; by 2001 surviving cod from tagging experiments conducted in 1997 would mostly be about 10 yrs old and beyond the optimal gill net selectivity size compared to those tagged in more recent years.

Although the tagging in the Burgeo area suggests that there may be mixing with Gulf cod even as late as mid-April in some years, our estimates of exploitation for cod tagged in this region are low and do not suggest cod in the Burgeo Bank area at that time, irrespective of their stock affinity, have been heavily exploited. In contrast, cod tagged in Placentia Bay have been more heavily exploited and there is a concentration of fishing effort in this portion of the stock area, particularly in July and again in November-December in most years. Local fishers have reported that the abundance of cod in Placentia Bay in late fall increased considerably during the moratorium. However, catch rates in Placentia Bay have declined dramatically in the past 3 years (Brattey et al. 2001), suggesting that the concentration of fishing effort in this area during 1998-2001 has reduced the size of this stock component considerably.

The estimates of exploitation for the offshore areas in 3Psh are substantially lower than those for other regions, in spite of substantial offshore landings. As in the previous assessment (Brattey et al. 2002) there are concerns that the estimates for the offshore may be too low. Possible reasons include, estimates of reporting rate that are too high, limited tagging coverage (both spatial and temporal), restricted distribution of fishing activity in the offshore, and possibly lower survival of fish caught for tagging offshore in deep-water. There have been substantial landings in some portions of the offshore where little or no tagging has been conducted (i.e. 3Pse, see Table 2) and more extensive tagging coverage, particularly on St. Pierre Bank during fall, would clearly be beneficial to address this concern.

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Table 1. Summary of details for cod tagging experiments conducted in NAFO Subdiv. 3Ps during 1997-2002 (PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay).

Year & expt no.	DFO Stat. area	Area of release	Dates	Gear	Depth (m)	Number tagged	Mean length (cm)
1997-001	3Psc	Bar Haven, NW PB	9-12 Apr.	handline	48-60	996	62.1
1997-002	3Psc	Clattice Hbr., NW PB	10 Apr.	handline	58-60	966	52.3
1997-004	3Psc	Bar Haven, NW PB	17-18 May	handline	50	817	65.0
1997-005	3Psc	St. Bride's, SE PB	25-28 May	handline	40	709	66.4
1997-006	3Psc	Oderin Bank, W PB	24-26 Jun.	handline	40	963	58.9
1997-008	3Psc	Lord's Cove, SW PB	25 Jun.-18 Jul.	trap/handline	18-40	793	53.5
1997-015	3Psc	Iona Islands, E PB	6-8 Nov.	handline	30-50	778	61.3
1998-001	3Psh	Halibut Channel	2-5 Apr.	otter trawl	181-307	1842	63.9
1998-002	3Psd	Hermitage Channel	5-7 Apr.	otter trawl	231-344	1352	53.9
1998-003	3Psc	Bar Haven, NW PB	22-25 April	handline	21-50	2073	61.0
1998-004	3Psc	Paradise Sound, W PB	27-29 April	otter trawl	151-206	1212	60.8
1998-005	3Psc	Wareham Rock, NW PB	May 1-3	handline	41-53	1037	61.9
1998-006	3Psb	Pool's Cove, FB	May 20-29	handline	67	938	57.5
1998-007	3Psc	Bar Haven, NW PB	19-24 Oct.	handline/otter trl.	41-60	511	60.3
1998-008	3Psc	Eastern Channel, PB	17-22 Oct.	handline	52-80	883	58.8
1999-003	3Psb	South of Pass Island, FB	8 Apr.	otter trawl	211-217	1293	57.0
1999-004	3Psc	head of Placentia Bay	29 Apr.-7 May	handline	20-70	2422	63.2
1999-002	3Psd	Hermitage Channel	4-7 Apr.	otter trawl	192-322	464	59.8
1999-001	3Psh	Halibut Channel	1-3 Apr.	otter trawl	149-239	1808	68.0
1999-039	3Psc	head of Placentia Bay	8-17 Nov	h'line/otter tr'l	50	2152	63.0
1999-043	3Psb	Hermitage Bay	30 Nov-1 Dec	handline	50	57	52.9
2000-001	3Psh	Halibut Channel	1-7 Apr	otter trawl	203-259	1044	85.8
2000-003	3Psd	Burgeo Bank	4-Apr	otter trawl	212-318	5	77.0
2000-004	3Psb	Pass Island	5-7 Apr	otter trawl	136-220	1665	53.1
2000-006	3Psb	Pool's Cove, FB	17-19 Apr	line-trawl	60-112	752	55.0
2000-007	3Psc	inner Placentia Bay	26 Apr - 6 May	handline	16-50	2494	60.5
2000-008	3Psc	inner Placentia Bay	27 Apr - 4 May	otter trawl	30-107	528	59.2
2000-033	3Psc	Bar Haven, PB	5-12 Nov.	handline	33-55	1165	59.0
2000-034	3Psc	Saturday Ledge, PB	10-12 Nov.	otter trawl	35-55	792	58.7
2000-035	3Psc	Eastern Channel, PB	13-15 Nov.	handline	35-63	1212	58.7
2001-001	3Psb	Pool's Cove, FB	9-11 Jan.	handline	55-92	200	57.5
2001-002	3Psb	Pool's Cove, FB	9-11 Jan.	linetrawl	73-92	388	56.1
2001-003	3Psh	Halibut Channel	12-14 Apr.	otter trawl	170-248	1144	80.8
2001-006	3Psd/a	Burgeo Bank	15-17 Apr.	otter trawl	179	999	53.8
2001-007	3Psd	NW St. Pierre Bank	16-17 Apr.	otter trawl	186-193	666	89.0
2001-008	3Psb	Pass Island, FB	18 Apr.	otter trawl	178-224	477	54.8
2001-009	3Psb	Fortune Bay	25-26 Apr.	handline	50-185	60	52.8
2001-010	3Psc	inner Placentia Bay	28 Apr.-6 May	otter trawl	35-230	1704	57.1
2001-011	3Psc	inner Placentia Bay	28 Apr.-7 May	handline	30-60	2273	58.7
2002-001	3Psb	Pool's Cove, FB	8-10 Jan.	handline	31-69	408	54.2
2002-002	3Psb	Pool's Cove, FB	8-10 Jan.	linetrawl	60-76	223	55.4
2002-003	3Psh	Halibut Channel	11-18 Apr.	otter trawl	150-279	1509	56.5
2002-004	3Psb	Pass Island, FB	13-14 Apr.	otter trawl	219-239	1792	54.0
2002-006	3Psd	SE Burgeo Bank	14-15 Apr.	otter trawl	136-369	963	64.8
2002-007	3Psc	inner Placentia Bay	27 Apr.-7 May	handline	20-45	1832	55.5
2002-008	3Psc	inner Placentia Bay	28 Apr.-7 May	otter trawl	17-48	1399	56.4
2002-012	3Psb	Grand Bank, FB	18 Jun.	handline	67	138	52.0

Table 2A. Reported monthly landings of cod from NAFO Subdiv. 3Ps during 2001.

	Inshore			Offshore						
Month	**3Psa**	**3Psb**	**3Psc**	**3Psd**	**3Pse**	**3Psf**	**3Psg**	**3Psh**	**3Ps_unk**	**Totals**
Jan	0.5	5.4	899.7	1.2	0.0	0.0	3.7	745.2	0.0	1655.8
Feb	1.4	0.9	2.0	8.3	0.0	41.9	7.2	997.6	0.0	1059.3
Mar	5.3	19.8	0.0	64.7	0.1	8.3	32.9	672.4	1.9	805.4
Apr	0.7	0.3	0.1	6.8	1.2	0.0	0.3	15.9	0.0	25.4
May	12.5	5.9	3.2	31.6	32.8	0.0	1.8	39.1	0.0	127.0
Jun	124.4	418.4	728.2	3.2	13.6	0.7	0.1	3.6	0.0	1292.2
Jul	186.1	462.6	1229.5	31.6	8.2	100.6	0.0	17.0	17.2	2052.7
Aug	162.2	355.9	495.4	83.2	46.3	173.3	26.3	71.9	38.8	1453.3
Sep	180.0	290.9	335.9	45.8	32.2	325.3	26.3	118.7	1.5	1356.7
Oct	214.8	185.7	370.9	18.7	112.6	226.2	14.9	18.3	0.0	1162.1
Nov	330.9	379.3	1385.9	26.4	0.0	420.8	2.6	357.3	2.5	2905.6
Dec	54.0	272.5	402.5	21.9	15.1	106.5	4.0	291.5	0.0	1168.1
Total	1272.9	2397.7	5853.3	343.3	262.1	1403.6	120.2	3348.6	61.9	15063.6

Table 2B. Reported landings of cod (t) by unit area from NAFO Subdiv. 3Ps during 1997-2001.

	Inshore			Offshore					
Year	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh	Total
1997	1191.4	1791.0	4955.5	256.2	110.0	90.0	0.0	1314.0	9708.1
1998	1573.3	2428.0	7102.3	1274.4	698.2	1107.7	377.1	4712.6	19273.6
1999	2696.9	3205.9	11653.6	873.3	359.6	2855.9	804.0	2108.5	24557.6
2000	1718.3	2263.0	8773.6	248.9	1002.8	3183.1	155.8	7741.6	25087.0
2001	1272.9	2397.7	5853.3	343.3	262.1	1403.6	120.2	3348.6	15001.7

Table 2C. Reported inshore landings of cod (t) by unit area from NAFO Divs. 3KL during 1998-2001.

Year	**3Ka**	**3Kd**	**3Kh**	**3Ki**	**3La**	**3Lb**	**3Lf**	**3Lj**	**3Lq**	**Totals**
1998	5.4	121.8	660.9	1331.0	1112.6	648.9	410.6	402.0	146.7	4840.0
1999	31.7	212.5	1117.0	2355.4	1498.1	1758.0	723.6	720.7	294.1	8711.1
2000	17.7	53.4	202.2	1174.5	1439.8	1410.3	396.5	435.4	194.5	5324.3
2001	27.5	170.0	417.9	1114.9	1560.0	2031.6	595.0	496.4	421.3	6834.6

Table 3. Annual summary of reported recaptures (all tag types combined) for cod tagged and released in NAFO Subdiv. 3Ps during 1997-2002 (PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay).

Year & expt no.	DFO Stat. area	Area of release	Dates of release	Number tagged	Reported recaptures						
					1997	1998	1999	2000	2001	2002	unk'n
1997-001	3Psc	Bar Haven, NW PB	9-12 Apr.	996	78	69	73	37	8	2	4
1997-002	3Psc	Clattice Hbr., NW PB	10 Apr.	966	91	42	53	27	7	3	6
1997-004	3Psc	Bar Haven, NW PB	17-18 May	817	103	43	84	51	5	3	3
1997-005	3Psc	St. Bride's, SE PB	25-28 May	709	27	46	85	42	8	1	2
1997-006	3Psc	Oderin Bank, W PB	24-26 Jun.	963	16	58	36	19	10	0	1
1997-008	3Psc	Lord's Cove, SW PB	25 Jun.-18 Jul.	794	28	69	50	26	13	1	2
1997-015	3Psc	Iona Islands, E PB	6-8 Nov.	784	0	39	89	32	9	1	5
					343	366	470	234	60	11	23
1998-001	3Psh	Halibut Channel	2-5 Apr.	1842	.	24	23	15	7	3	3
1998-002	3Psd	Hermitage Channel	5-7 Apr.	1352	.	39	50	20	10	1	1
1998-003	3Psc	Bar Haven, NW PB	22-25 April	2073	.	124	309	144	34	4	11
1998-004	3Psc	Paradise Sound, W PB	27-29 April	1212	.	152	191	104	20	0	7
1998-005	3Psc	Wareham Rock, NW PB	May 1-3	1037	.	80	208	93	25	2	9
1998-006	3Psb	Pool's Cove, FB	May 20-29	938	.	87	91	44	24	9	0
1998-008	3Psc	Bar Haven, NW PB	19-24 Oct.	511	.	6	79	38	22	5	1
1998-009	3Psc	Eastern Channel, PB	17-22 Oct.	883	.	29	102	84	36	9	9
					.	541	1053	542	178	33	41
1999-001	3Psh	Halibut Channel	1-3 Apr.	1808	.	.	39	45	20	9	1
1999-002	3Psd	Hermitage Channel	4-7 Apr.	464	.	.	29	12	2	4	0
1999-003	3Psb	South of Pass Island, FB	8 Apr.	1293	.	.	76	60	31	8	1
1999-004	3Psc	head of Placentia Bay	29 Apr.-7 May	2422	.	.	399	284	106	16	18
1999-039	3Psc	head of Placentia Bay	8-17 Nov	2152	.	.	68	378	115	22	12
1999-043	3Psb	Hermitage Bay	30 Nov-1 Dec	57	.	.	1	6	2	1	0
					.	.	612	785	276	60	32
2000-001	3Psh	Halibut Channel	1-7 Apr.	1044	.	.	.	2	12	1	0
2000-003	3Psd	Burgeo Bank	4-Apr	5	.	.	.	0	0	0	0
2000-004	3Psb	Pass Island	5-7 Apr	1665	.	.	.	92	44	24	2
2000-006	3Psb	Pool's Cove, FB	17-19 Apr	752	.	.	.	60	58	21	4
2000-007	3Psc	inner Placentia Bay	26 Apr - 6 May	2494	.	.	.	317	260	48	14
2000-008	3Psc	inner Placentia Bay	27 Apr - 4 May	528	.	.	.	66	41	8	3
2000-033	3Psc	Bar Haven, PB	5-12 Nov.	1165	.	.	.	46	145	13	5
2000-034	3Psc	Saturday Ledge, PB	10-12 Nov.	792	.	.	.	41	77	19	7
2000-035	3Psc	Eastern Channel, PB	13-15 Nov.	1212	.	.	.	49	128	13	7
					.	.	.	673	765	147	42
2001-001	3Psb	Pool's Cove, FB	9-11 Jan.	200	.	.	.	.	25	9	0
2001-002	3Psb	Pool's Cove, FB	9-11 Jan.	388	.	.	.	.	52	9	3
2001-003	3Psh	Halibut Channel	12-14 Apr.	1144	.	.	.	.	10	9	0
2001-006	3Psd/a	Burgeo Bank	15-17 Apr.	999	.	.	.	.	55	15	1
2001-007	3Psd	NW St. Pierre Bank	16-17 Apr.	666	.	.	.	.	25	7	0
2001-008	3Psb	Pass Island, FB	18 Apr.	477	.	.	.	.	14	9	0
2001-009	3Psb	Fortune Bay	25-26 Apr.	60	.	.	.	.	4	4	0
2001-010	3Psc	inner Placentia Bay	28 Apr.-6 May	1704	.	.	.	.	208	64	17
2001-011	3Psc	inner Placentia Bay	28 Apr.-7 May	2273	.	.	.	.	322	90	9
2001-025	3Psa	Ramea	1 Aug.	7	.	.	.	.	0	1	0
2001-027	3Psc	inner Placentia Bay	22 Nov.	350	.	.	.	.	5	14	1
					.	.	.	.	720	231	31
2002-001	3Psb	Pool's Cove, FB	8-10 Jan.	408	.	.	.	.	.	9	0
2002-002	3Psb	Pool's Cove, FB	8-10 Jan.	223	.	.	.	.	.	15	0
2002-003	3Psh	Halibut Channel	11-18 Apr.	1509	.	.	.	.	.	4	0
2002-004	3Psb	Pass Island, FB	13-14 Apr.	1792	.	.	.	.	.	25	0
2002-006	3Psd	SE Burgeo Bank	14-15 Apr.	963	.	.	.	.	.	8	0
2002-007	3Psc	inner Placentia Bay	27 Apr.-7 May	1832	.	.	.	.	.	50	0
2002-008	3Psc	inner Placentia Bay	28 Apr.-7 May	1399	.	.	.	.	.	47	0
2002-012	3Psb	Grand Bank, FB	18 Jun.	138	.	.	.	.	.	6	0
					.	.	.	.	.	164	0

Table 4. Annual estimates of exploitation (harvest rates) by experiment for cod tagged in NAFO Subdiv. 3Ps during 1997-2002. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss, and assumed natural mortality. Shaded cells represent estimates for experiments conducted during the fishing season and account for only a portion of exploitation in the year of release. See text for further details.

					Reported landings (t)					
					9,045	19,694	28,111	25,100	15,000	~8,000
DFO Stat.	Year &			Number	Exploitation rates					
area	expt no.	Area of release	Dates	tagged	1997	1998	1999	2000	2001	2002*
3Psa	1999-043	Hermitage Bay	30 Nov-1 Dec	57	.	.	0.02	0.17	0.07	0.04
3Psa	2001-025	Ramea	1-Aug	7	.	.	.	.	0.00	0.20
3Psb	1998-006	Poole's Cove, FB	20-29 May	938	.	0.13	0.19	0.13	0.11	0.05
3Psb	1999-003	Pass Island, FB	8-Apr	1293	.	.	0.10	0.10	0.07	0.02
3Psb	2000-004	Pass Island	5-7 Apr	1665	.	.	.	0.08	0.06	0.04
3Psb	2000-006	Poole's Cove, FB	17-19 Apr	752	.	.	.	0.13	0.18	0.09
3Psb	2001-001	Poole's Cove, FB	9-11 Jan	200	.	.	.	.	0.23	0.13
3Psb	2001-002	Poole's Cove, FB	9-11 Jan	388	.	.	.	.	0.25	0.07
3Psb	2001-008	Pass Island, FB	18-Apr	477	.	.	.	.	0.05	0.03
3Psb	2001-009	Fortune Bay	25-26 Apr	60	.	.	.	.	0.11	0.14
3Psb	2002-001	Poole's Cove, FB	8-10 Jan	408	.	.	.	.	.	0.04
3Psb	2002-002	Poole's Cove, FB	8-10 Jan	222	.	.	.	.	.	0.12
3Psb	2002-004	Pass Island, FB	13-14 Apr	1792	.	.	.	.	.	0.02
3Psb	2002-012	Grand Bank, FB	18-Jun	138	.	.	.	.	.	0.05
3Psc	1997-001	Bar Haven, NW PB	9-12 Apr	996	0.11	0.15	0.22	0.15	0.05	0.01
3Psc	1997-002	Clattice Hbr., NW PB	10-Apr	966	0.13	0.09	0.16	0.11	0.04	0.02
3Psc	1997-004	Bar Haven, NW PB	17-18 May	817	0.17	0.11	0.30	0.29	0.04	0.03
3Psc	1997-005	St. Bride's, SE PB	25-28 May	709	0.06	0.12	0.32	0.26	0.08	0.01
3Psc	1997-006	Oderin Bank, W PB	24-26 Jun	963	0.03	0.12	0.10	0.07	0.05	0.00
3Psc	1997-008	Lord's Cove, SW PB	25 Jun-18 Jul	793	0.05	0.15	0.15	0.11	0.08	0.01
3Psc	1997-015	Iona Islands, E PB	6-8 Nov	778	0.00	0.08	0.24	0.13	0.05	0.01
3Psc	1998-003	Bar Haven, NW PB	22-25 April	2073	.	0.09	0.31	0.23	0.09	0.01
3Psc	1998-004	Paradise Sound, W PB	27-29 April	1212	.	0.19	0.34	0.35	0.13	0.00
3Psc	1998-005	Wareham Rock, NW PB	May 1-3	1037	.	0.12	0.42	0.37	0.19	0.02
3Psc	1998-008	Bar Haven, NW PB	19-24 Oct	511	.	0.02	0.25	0.18	0.16	0.04
3Psc	1998-009	Eastern Channel, PB	17-22 Oct.	883	.	0.04	0.19	0.22	0.15	0.05
3Psc	1999-004	inner Placentia Bay	29 Apr.-7 May	2422	.	.	0.29	0.32	0.22	0.05
3Psc	1999-039	inner Placentia Bay	8-17 Nov	2152	.	.	0.05	0.30	0.16	0.04
3Psc	2000-007	inner Placentia Bay	26 Apr - 6 May	2494	.	.	.	0.22	0.27	0.08
3Psc	2000-008	inner Placentia Bay	27 Apr - 4 May	528	.	.	.	0.21	0.19	0.06
3Psc	2000-033	Bar Haven, PB	5-12 Nov	1165	.	.	.	0.06	0.23	0.03
3Psc	2000-034	Saturday Ledge, PB	10-12 Nov	792	.	.	.	0.06	0.18	0.06
3Psc	2000-035	Eastern Channel, PB	13-15 Nov	1212	.	.	.	0.06	0.19	0.03
3Psc	2001-010	inner Placentia Bay	28 Apr.-6 May	1704	.	.	.	.	0.22	0.10
3Psc	2001-011	inner Placentia Bay	28 Apr.-7 May	2273	.	.	.	.	0.26	0.11
3Psc	2001-027	western Channel, PB	22-23 Nov	350	.	.	.	.	0.02	0.07
3Psc	2002-007	inner Placentia Bay	27 Apr - 7 May	1832	.	.	.	.	.	0.04
3Psc	2002-008	inner Placentia Bay	28 Apr - 7 May	1399	.	.	.	.	.	0.05
3Psd	1998-002	Hermitage Channel	5-7 Apr	1352	.	0.04	0.07	0.03	0.02	0.00
3Psd	1999-002	Hermitage Channel	4-7 Apr	464	.	.	0.10	0.06	0.01	0.02
3Psd/a	2001-006	Burgeo Bank	15-17 Apr	999	.	.	.	.	0.10	0.03
3Psd	2001-007	NW St. Pierre Bank	16-17 Apr	666	.	.	.	.	0.06	0.02
3Psd	2002-006	SE Burgeo Bank	14-15 Apr	963	.	.	.	.	.	0.02
3Psh	1998-001	Halibut Channel	2-5 Apr.	1842	.	0.02	0.02	0.02	0.01	0.01
3Psh	1999-001	Halibut Channel	1-3 Apr	1808	.	.	0.03	0.04	0.03	0.01
3Psh	2000-001	Halibut Channel	1-7 Apr	1044	.	.	.	0.00	0.02	0.00
3Psh	2001-003	Halibut Channel	12-14 Apr	1144	.	.	.	.	0.01	0.01
3Psh	2002-003	Halibut Channel	11-18 Apr	1509	.	.	.	.	.	0.00

* based on tags received up to 30 September 2002

Table 5. Annual distribution of recaptures of cod tagged and released in various regions of NAFO Subdiv. 3Ps during 1997_2001. Recaptures were adjusted by region-specific tag reporting rates obtained from a high-reward tagging study. Shaded cells give the percentage recaptured in the area of release. Values for 2002 are based on tags received up to 7 September 2002.

Release area	Year	Number tagged	Recapture year	Adj. nos. recaptured	3K	3LA (Bonavista)	3LB (Trinity)	3LF (Concep'n)	3LJ (E. Avalon)	3LQ (S. Avalon)	3NO (G. Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (Gulf)	UNK
3PSA	1999	57	1999	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
			2000	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	85.7	0.0	0.0	0.0	0.0	0.0
			2001	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
	2001	172	2001	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	20.0	0.0	50.0	0.0
			2002	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	50.0
3PSB	1998	939	1998	101	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	70.3	18.8	0.0	0.0	4.0	0.0
			1999	108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	64.8	20.4	0.0	0.0	5.6	1.9
			2000	51	0.0	0.0	0.0	0.0	2.0	0.0	0.0	3.9	70.6	19.6	0.0	2.0	0.0	2.0
			2001	28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.9	50.0	28.6	0.0	0.0	3.6	0.0
			2002	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.0	10.0	0.0	0.0	0.0	0.0
	1999	1293	1999	93	0.0	0.0	1.1	0.0	1.1	1.1	0.0	4.3	28.0	63.4	0.0	1.1	0.0	0.0
			2000	74	0.0	0.0	0.0	4.1	1.4	1.4	0.0	2.7	41.9	43.2	0.0	2.7	2.7	0.0
			2001	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	18.4	68.4	0.0	2.6	0.0	2.6
			2002	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	66.7	0.0	11.1	0.0	0.0
	2000	2417	2000	190	0.0	0.0	0.0	0.0	0.5	0.0	0.0	2.6	56.8	35.3	0.0	0.5	1.1	3.2
			2001	131	0.0	0.0	0.0	0.0	0.8	3.1	0.0	3.1	61.1	26.0	1.5	0.8	3.1	0.8
			2002	56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	58.9	33.9	0.0	1.8	0.0	1.8
	2001	1125	2001	118	0.0	0.0	0.8	0.0	0.8	4.2	0.0	2.5	59.3	30.5	0.0	0.0	0.0	1.7
			2002	39	0.0	0.0	0.0	0.0	0.0	2.6	0.0	2.6	79.5	10.3	0.0	0.0	0.0	5.1
	2002	2560	2002	68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	61.8	29.4	0.0	0.0	0.0	7.4
3PSC	1997	6029	1997	404	0.0	0.0	0.2	0.2	0.2	0.5	0.0	0.0	4.0	93.3	0.0	0.2	0.0	1.2
			1998	433	0.0	0.0	0.7	1.4	4.2	1.4	0.5	0.2	12.2	75.3	0.7	1.4	0.5	1.6
			1999	549	0.4	0.2	1.1	3.1	1.5	1.6	0.0	0.2	7.7	81.6	0.0	1.1	0.0	1.6
			2000	277	0.4	0.7	0.4	0.0	0.7	0.7	0.0	0.7	7.2	83.0	0.0	4.3	0.4	1.4
			2001	72	0.0	0.0	1.4	0.0	0.0	1.4	0.0	1.4	12.5	79.2	0.0	4.2	0.0	0.0
			2002	13	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	15.4	38.5	0.0	30.8	0.0	7.7
	1998	5716	1998	449	0.0	0.0	0.7	2.4	4.2	1.3	0.0	0.2	1.1	88.9	0.0	0.0	0.0	1.1
			1999	1008	0.3	0.4	2.2	2.3	1.9	1.3	0.0	0.2	4.3	85.0	0.0	0.8	0.0	1.4
			2000	534	0.6	0.2	0.6	0.4	0.4	2.1	0.0	0.2	5.1	88.8	0.0	1.3	0.0	0.6
			2001	156	1.3	0.6	0.0	0.6	1.3	4.5	0.0	0.0	3.8	84.6	0.0	2.6	0.0	0.6
			2002	23	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.0	0.0	4.3	0.0	4.3
	1999	4574	1999	593	0.0	0.0	0.7	0.5	0.8	0.7	0.0	0.0	0.8	96.0	0.0	0.0	0.0	0.5
			2000	825	0.0	0.0	0.4	0.1	0.5	1.1	0.0	0.0	2.9	94.7	0.0	0.1	0.0	0.2
			2001	276	0.0	0.4	0.4	0.7	1.1	3.6	0.0	0.0	2.2	88.4	0.0	1.8	0.0	1.4
			2002	47	0.0	2.1	0.0	0.0	2.1	2.1	0.0	2.1	8.5	80.9	0.0	0.0	0.0	2.1
	2000	6191	2000	657	0.0	0.0	0.0	0.0	0.5	1.1	0.0	0.0	1.5	95.4	0.3	0.0	0.0	1.2
			2001	826	0.0	0.0	0.4	0.7	1.0	4.5	0.0	0.1	1.2	90.2	0.0	0.8	0.0	1.1
			2002	129	0.0	0.8	0.0	0.0	0.0	2.3	0.0	0.0	0.8	91.5	1.6	3.1	0.0	0.0
	2001	4326	2001	692	0.1	0.1	0.1	1.4	0.7	5.6	0.0	0.0	1.2	88.0	0.0	0.7	0.0	1.9
			2002	217	0.0	0.5	0.5	0.5	0.0	1.4	0.0	0.5	1.4	93.1	0.0	0.9	0.0	1.4
	2002	3231	2002	126	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	97.6	0.0	0.0	0.0	0.0

contd.

Table 4. Annual estimates of exploitation (harvest rates) by experiment for cod tagged in NAFO Subdiv. 3Ps during 1997-2002. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss, and assumed natural mortality. Shaded cells represent estimates for experiments conducted during the fishing season and account for only a portion of exploitation in the year of release. See text for further details.

					Reported landings (t)					
					9,045	19,694	28,111	25,100	15,000	~8,000
DFO Stat.	Year &			Number	Exploitation rates					
area	expt no.	Area of release	Dates	tagged	1997	1998	1999	2000	2001	2002*
3Psa	1999-043	Hermitage Bay	30 Nov-1 Dec	57			0.02	0.17	0.07	0.04
3Psa	2001-025	Ramea	1-Aug	7					0.00	0.20
3Psb	1998-006	Poole's Cove, FB	20-29 May	938		0.13	0.19	0.13	0.11	0.05
3Psb	1999-003	Pass Island, FB	8-Apr	1293			0.10	0.10	0.07	0.02
3Psb	2000-004	Pass Island	5-7 Apr	1665				0.08	0.06	0.04
3Psb	2000-006	Poole's Cove, FB	17-19 Apr	752				0.13	0.18	0.09
3Psb	2001-001	Poole's Cove, FB	9-11 Jan	200					0.23	0.13
3Psb	2001-002	Poole's Cove, FB	9-11 Jan	388					0.25	0.07
3Psb	2001-008	Pass Island, FB	18-Apr	477					0.05	0.03
3Psb	2001-009	Fortune Bay	25-26 Apr	60					0.11	0.14
3Psb	2002-001	Poole's Cove, FB	8-10 Jan	408						0.04
3Psb	2002-002	Poole's Cove, FB	8-10 Jan	222						0.12
3Psb	2002-004	Pass Island, FB	13-14 Apr	1792						0.02
3Psb	2002-012	Grand Bank, FB	18-Jun	138						0.05
3Psc	1997-001	Bar Haven, NW PB	9-12 Apr	996	0.11	0.15	0.22	0.15	0.05	0.01
3Psc	1997-002	Clattice Hbr., NW PB	10-Apr	966	0.13	0.09	0.16	0.11	0.04	0.02
3Psc	1997-004	Bar Haven, NW PB	17-18 May	817	0.17	0.11	0.30	0.29	0.04	0.03
3Psc	1997-005	St. Bride's, SE PB	25-28 May	709	**0.06**	0.12	0.32	0.26	0.08	0.01
3Psc	1997-006	Oderin Bank, W PB	24-26 Jun	963	**0.03**	0.12	0.10	0.07	0.05	0.00
3Psc	1997-008	Lord's Cove, SW PB	25 Jun-18 Jul	793	**0.05**	0.15	0.15	0.11	0.08	0.01
3Psc	1997-015	Iona Islands, E PB	6-8 Nov	778	**0.00**	0.08	0.24	0.13	0.05	0.01
3Psc	1998-003	Bar Haven, NW PB	22-25 April	2073		0.09	0.31	0.23	0.09	0.01
3Psc	1998-004	Paradise Sound, W PB	27-29 April	1212		0.19	0.34	0.35	0.13	0.00
3Psc	1998-005	Wareham Rock, NW PB	May 1-3	1037		0.12	0.42	0.37	0.19	0.02
3Psc	1998-008	Bar Haven, NW PB	19-24 Oct	511		**0.02**	0.25	0.18	0.16	0.04
3Psc	1998-009	Eastern Channel, PB	17-22 Oct.	883		**0.04**	0.19	0.22	0.15	0.05
3Psc	1999-004	inner Placentia Bay	29 Apr.-7 May	2422			0.29	0.32	0.22	0.05
3Psc	1999-039	inner Placentia Bay	8-17 Nov	2152			**0.05**	0.30	0.16	0.04
3Psc	2000-007	inner Placentia Bay	26 Apr - 6 May	2494				0.22	0.27	0.08
3Psc	2000-008	inner Placentia Bay	27 Apr - 4 May	528				0.21	0.19	0.06
3Psc	2000-033	Bar Haven, PB	5-12 Nov	1165				**0.06**	0.23	0.03
3Psc	2000-034	Saturday Ledge, PB	10-12 Nov	792				**0.08**	0.18	0.06
3Psc	2000-035	Eastern Channel, PB	13-15 Nov	1212				**0.06**	0.19	0.03
3Psc	2001-010	inner Placentia Bay	28 Apr.-6 May	1704					0.22	0.10
3Psc	2001-011	inner Placentia Bay	28 Apr.-7 May	2273					0.26	0.11
3Psc	2001-027	western Channel, PB	22-23 Nov	350					**0.02**	0.07
3Psc	2002-007	inner Placentia Bay	27 Apr - 7 May	1832						0.04
3Psc	2002-008	inner Placentia Bay	28 Apr - 7 May	1399						0.05
3Psd	1998-002	Hermitage Channel	5-7 Apr	1352		0.04	0.07	0.03	0.02	0.00
3Psd	1999-002	Hermitage Channel	4-7 Apr	464			0.10	0.06	0.01	0.02
3Psd/a	2001-006	Burgeo Bank	15-17 Apr	999					0.10	0.03
3Psd	2001-007	NW St. Pierre Bank	16-17 Apr	666					0.06	0.02
3Psd	2002-006	SE Burgeo Bank	14-15 Apr	963						0.02
3Psh	1998-001	Halibut Channel	2-5 Apr.	1842		0.02	0.02	0.02	0.01	0.01
3Psh	1999-001	Halibut Channel	1-3 Apr	1808			0.03	0.04	0.03	0.01
3Psh	2000-001	Halibut Channel	1-7 Apr	1044				0.00	0.02	0.00
3Psh	2001-003	Halibut Channel	12-14 Apr	1144					0.01	0.01
3Psh	2002-003	Halibut Channel	11-18 Apr	1509						0.00

* based on tags received up to 30 September 2002

Table 5. Annual distribution of recaptures of cod tagged and released in various regions of NAFO Subdiv. 3Ps during 1997_2001. Recaptures were adjusted by region-specific tag reporting rates obtained from a high-reward tagging study. Shaded cells give the percentage recaptured in the area of release. Values for 2002 are based on tags received up to 7 September 2002.

Release area	Year	Number tagged	Recapture year	Adj.nos. recaptured	3K	3LA (Bonavista)	3LB (Trinity)	3LF (Concepn)	3LJ (E Avalon)	3LQ (S Avalon)	3NO (G Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (Gulf)	UNK
3PSA	1999	57	1999	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
			2000	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	85.7	0.0	0.0	0.0	0.0	0.0
			2001	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
	2001	172	2001	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	0.0	0.0	20.0	0.0	50.0	0.0
			2002	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	50.0
3PSB	1998	939	1998	101	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	70.3	18.8	0.0	0.0	4.0	0.0
			1999	108	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	64.8	20.4	0.0	0.0	5.6	1.9
			2000	51	0.0	0.0	0.0	0.0	2.0	0.0	0.0	3.9	70.6	19.6	0.0	2.0	0.0	2.0
			2001	28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.9	50.0	28.6	0.0	0.0	3.6	0.0
			2002	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.0	10.0	0.0	0.0	0.0	0.0
	1999	1293	1999	93	0.0	0.0	1.1	0.0	1.1	1.1	0.0	4.3	28.0	63.4	0.0	1.1	0.0	0.0
			2000	74	0.0	0.0	0.0	4.1	1.4	1.4	0.0	2.7	41.9	43.2	0.0	2.7	2.7	0.0
			2001	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	18.4	68.4	0.0	2.6	0.0	2.6
			2002	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	66.7	0.0	11.1	0.0	0.0
	2000	2417	2000	190	0.0	0.0	0.0	0.0	0.5	0.0	0.0	2.6	56.8	35.3	0.0	0.5	1.1	3.2
			2001	131	0.0	0.0	0.0	0.0	0.8	3.1	0.0	3.1	61.1	26.0	1.5	0.8	3.1	0.8
			2002	56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	58.9	33.9	0.0	1.8	0.0	1.8
	2001	1125	2001	118	0.0	0.0	0.8	0.0	0.8	4.2	0.0	2.5	59.3	30.5	0.0	0.0	0.0	1.7
			2002	39	0.0	0.0	0.0	0.0	0.0	2.6	0.0	2.6	79.5	10.3	0.0	0.0	0.0	5.1
	2002	2560	2002	68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	61.8	29.4	0.0	0.0	0.0	7.4
3PSC	1997	6029	1997	404	0.0	0.0	0.2	0.2	0.2	0.5	0.0	0.0	4.0	93.3	0.0	0.2	0.0	1.2
			1998	433	0.0	0.0	0.7	1.4	4.2	1.4	0.5	0.2	12.2	75.3	0.7	1.4	0.5	1.6
			1999	549	0.4	0.2	1.1	3.1	1.5	1.6	0.0	0.2	7.7	81.6	0.0	1.1	0.0	1.6
			2000	277	0.4	0.7	0.4	0.0	0.7	0.7	0.0	0.7	7.2	83.0	0.0	4.3	0.4	1.4
			2001	72	0.0	0.0	1.4	0.0	0.0	1.4	0.0	1.4	12.5	79.2	0.0	4.2	0.0	0.0
			2002	13	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	15.4	38.5	0.0	30.8	0.0	7.7
	1998	5716	1998	449	0.0	0.0	0.7	2.4	4.2	1.3	0.0	0.2	1.1	88.9	0.0	0.0	0.0	1.1
			1999	1008	0.3	0.4	2.2	2.3	1.9	1.3	0.0	0.2	4.3	85.0	0.0	0.8	0.0	1.4
			2000	534	0.6	0.2	0.6	0.4	0.4	2.1	0.0	0.2	5.1	88.8	0.0	1.3	0.0	0.6
			2001	156	1.3	0.6	0.0	0.6	1.3	4.5	0.0	0.0	3.8	84.6	0.0	2.6	0.0	0.6
			2002	23	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.0	0.0	4.3	0.0	4.3
	1999	4574	1999	593	0.0	0.0	0.7	0.5	0.8	0.7	0.0	0.0	0.8	96.0	0.0	0.0	0.0	0.5
			2000	825	0.0	0.0	0.4	0.1	0.5	1.1	0.0	0.0	2.9	94.7	0.0	0.1	0.0	0.2
			2001	276	0.0	0.4	0.4	0.7	1.1	3.6	0.0	0.0	2.2	88.4	0.0	1.8	0.0	1.4
			2002	47	0.0	2.1	0.0	0.0	2.1	2.1	0.0	2.1	8.5	80.9	0.0	0.0	0.0	2.1
	2000	6191	2000	657	0.0	0.0	0.0	0.0	0.5	1.1	0.0	0.0	1.5	95.4	0.3	0.0	0.0	1.2
			2001	826	0.0	0.0	0.4	0.7	1.0	4.5	0.0	0.1	1.2	90.2	0.0	0.8	0.0	1.1
			2002	129	0.0	0.8	0.0	0.0	0.0	2.3	0.0	0.0	0.8	91.5	1.6	3.1	0.0	0.0
	2001	4326	2001	692	0.1	0.1	0.1	1.4	0.7	5.6	0.0	0.0	1.2	88.0	0.0	0.7	0.0	1.9
			2002	217	0.0	0.5	0.5	0.5	0.0	1.4	0.0	0.5	1.4	93.1	0.0	0.9	0.0	1.4
	2002	3231	2002	126	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	97.6	0.0	0.0	0.0	0.0

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Table 5. Contd.

Release area	Year	Number tagged	Recapture year	Adj. nos. recaptured	3K	3LA (Bonavista)	3LB (Trinity)	3LF (Conc'p'n)	3LJ (E. Avalon)	3LQ (S. Avalon)	3NO (G. Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (Gulf)	UNK
3PSD	1998	1352	1998	46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	10.9	26.1	2.2	2.2	45.7	2.2
			1999	59	1.7	0.0	1.7	0.0	0.0	0.0	0.0	11.9	5.1	15.3	0.0	1.7	54.2	8.5
			2000	23	4.3	0.0	0.0	0.0	0.0	0.0	0.0	17.4	4.3	8.7	0.0	4.3	56.5	4.3
			2001	12	0.0	0.0	0.0	8.3	0.0	8.3	0.0	0.0	0.0	8.3	0.0	8.3	66.7	0.0
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
	1999	464	1999	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7	11.1	22.2	5.6	8.3	8.3	2.8
			2000	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	31.3	31.3	0.0	25.0	0.0
			2001	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2002	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	50.0	0.0	25.0
	2001	1500	2001	110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	3.6	7.3	14.5	9.1	45.5	12.7
			2002	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	17.2	13.8	6.9	6.9	34.5	10.3
	2002	963	2002	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.8	0.0	0.0	0.0	61.5	7.7
3PSH	1998	1842	1998	26	0.0	0.0	0.0	3.8	0.0	0.0	3.8	0.0	0.0	19.2	0.0	69.2	0.0	3.8
			1999	26	0.0	0.0	0.0	3.8	3.8	0.0	0.0	0.0	0.0	34.6	0.0	50.0	3.8	3.8
			2000	17	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0	5.9	23.5	0.0	58.8	0.0	5.9
			2001	7	0.0	0.0	14.3	0.0	0.0	0.0	0.0	14.3	0.0	42.9	0.0	14.3	0.0	14.3
			2002	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	66.7	0.0	0.0
	1999	1808	1999	45	2.2	0.0	2.2	2.2	8.9	2.2	4.4	0.0	0.0	37.8	0.0	31.1	0.0	8.9
			2000	54	0.0	0.0	0.0	5.6	0.0	1.9	1.9	0.0	0.0	20.4	5.6	44.4	0.0	20.4
			2001	24	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	4.2	33.3	0.0	50.0	0.0	8.3
			2002	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	20.0	0.0	20.0
	2000	1044	2000	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0	0.0	0.0
			2001	14	0.0	0.0	0.0	0.0	0.0	7.1	14.3	0.0	0.0	7.1	0.0	50.0	0.0	21.4
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	2001	1144	2001	12	0.0	0.0	0.0	0.0	0.0	8.3	8.3	0.0	0.0	25.0	0.0	50.0	0.0	8.3
			2002	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.2	0.0	54.5	0.0	27.3
	2002	1509	2002	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	25.0	0.0	50.0

Table 5. Contd.

Release area	Year	Number tagged	Recapture year	Adj. nos. recaptured	3K	3LA (Bonavista)	3LB (Trinity)	3LF (Conception)	3LJ (E. Avalon)	3LQ (S. Avalon)	3NO (G. Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (Gulf)	UNK
3PSD	1998	1352	1998	46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	10.9	26.1	2.2	2.2	45.7	2.2
			1999	59	1.7	0.0	1.7	0.0	0.0	0.0	0.0	11.9	5.1	15.3	0.0	1.7	54.2	8.5
			2000	23	4.3	0.0	0.0	0.0	0.0	0.0	0.0	17.4	4.3	8.7	0.0	4.3	56.5	4.3
			2001	12	0.0	0.0	0.0	8.3	0.0	8.3	0.0	0.0	0.0	8.3	0.0	8.3	66.7	0.0
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
	1999	464	1999	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7	11.1	22.2	5.6	8.3	8.3	2.8
			2000	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	31.3	31.3	0.0	25.0	0.0
			2001	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2002	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	50.0	0.0	25.0
	2001	1500	2001	110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	3.6	7.3	14.5	9.1	45.5	12.7
			2002	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	17.2	13.8	6.9	6.9	34.5	10.3
	2002	963	2002	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.8	0.0	0.0	0.0	61.5	7.7
3PSH	1998	1842	1998	26	0.0	0.0	0.0	3.8	0.0	0.0	3.8	0.0	0.0	19.2	0.0	69.2	0.0	3.8
			1999	26	0.0	0.0	0.0	3.8	3.8	0.0	0.0	0.0	0.0	34.6	0.0	50.0	3.8	3.8
			2000	17	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	5.9	23.5	0.0	58.8	0.0	5.9
			2001	7	0.0	0.0	14.3	0.0	0.0	0.0	0.0	14.3	0.0	42.9	0.0	14.3	0.0	14.3
			2002	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	66.7	0.0	0.0
	1999	1808	1999	45	2.2	0.0	2.2	2.2	8.9	2.2	4.4	0.0	0.0	37.8	0.0	31.1	0.0	8.9
			2000	54	0.0	0.0	0.0	5.6	0.0	1.9	1.9	0.0	0.0	20.4	5.6	44.4	0.0	20.4
			2001	24	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	4.2	33.3	0.0	50.0	0.0	8.3
			2002	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	20.0	0.0	20.0
	2000	1044	2000	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	0.0	0.0
			2001	14	0.0	0.0	0.0	0.0	0.0	7.1	14.3	0.0	0.0	7.1	0.0	50.0	0.0	21.4
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	2001	1144	2001	12	0.0	0.0	0.0	0.0	0.0	8.3	8.3	0.0	0.0	25.0	0.0	50.0	0.0	8.3
			2002	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.2	0.0	54.5	0.0	27.3
	2002	1509	2002	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	25.0	0.0	50.0

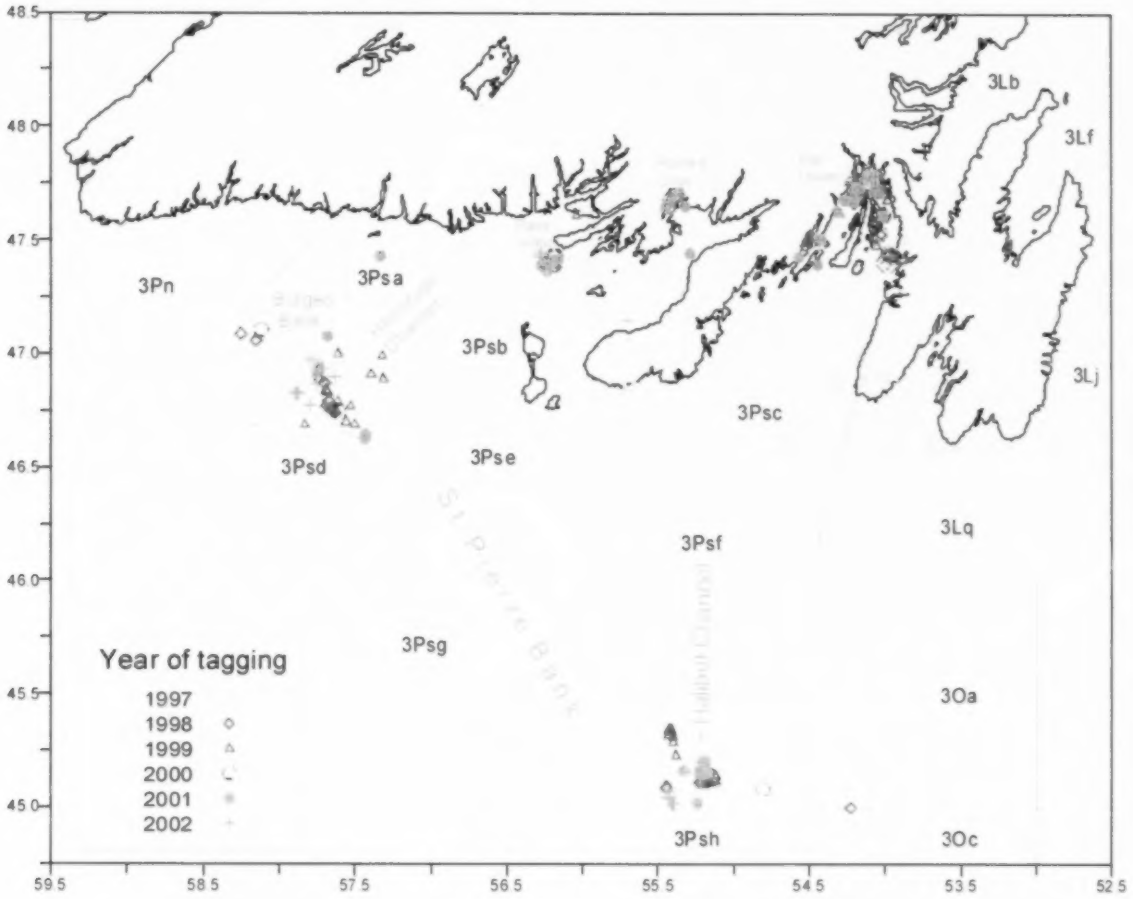


Fig. 1. Locations where cod were tagged and released off southern Newfoundland during April 1997- September 2002, along with boundaries of unit areas, French economic zone, and the 100 m depth contour.

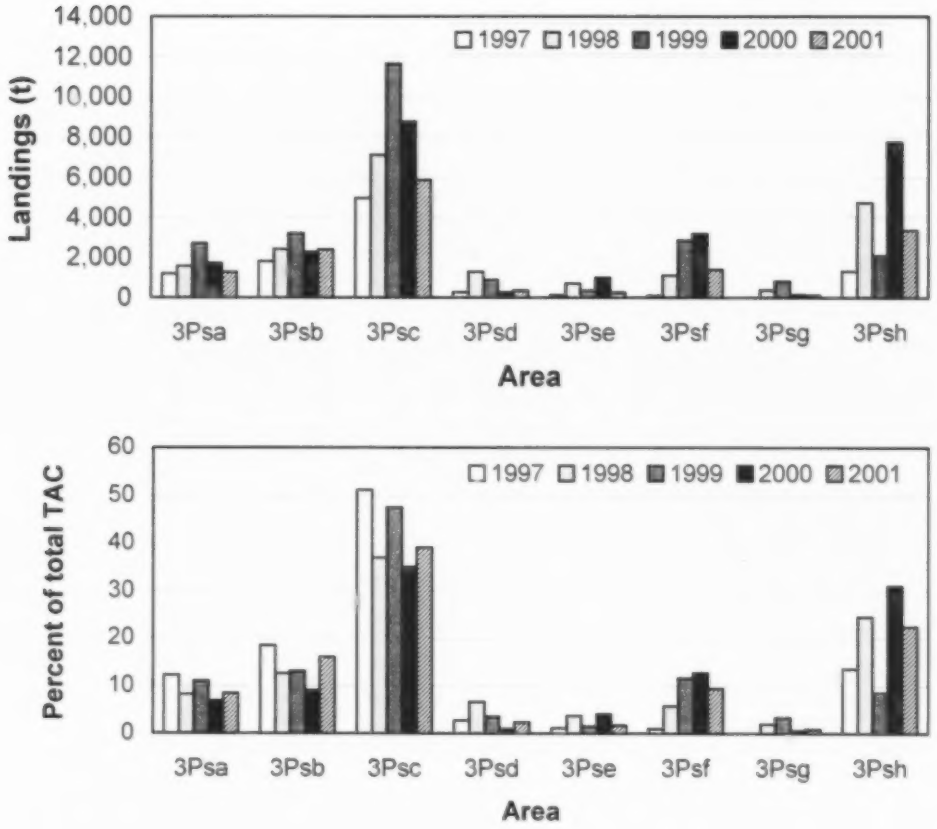
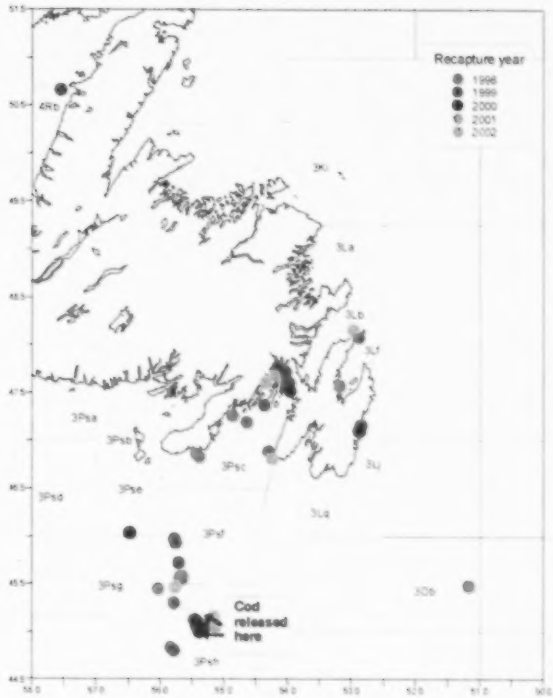
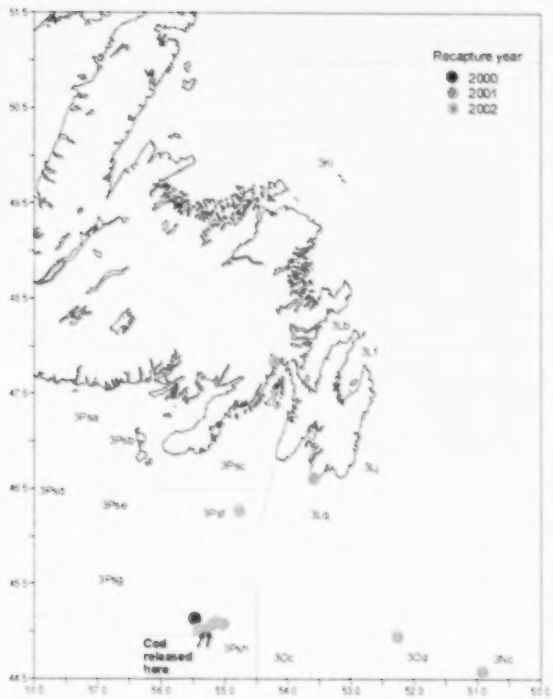


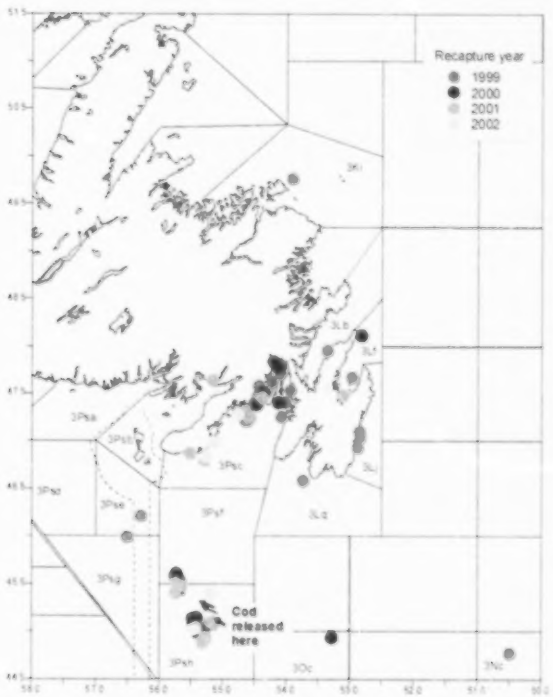
Fig. 2. Annual reported landings of cod by unit area from NAFO Subdiv. 3Ps during 1997-2001.



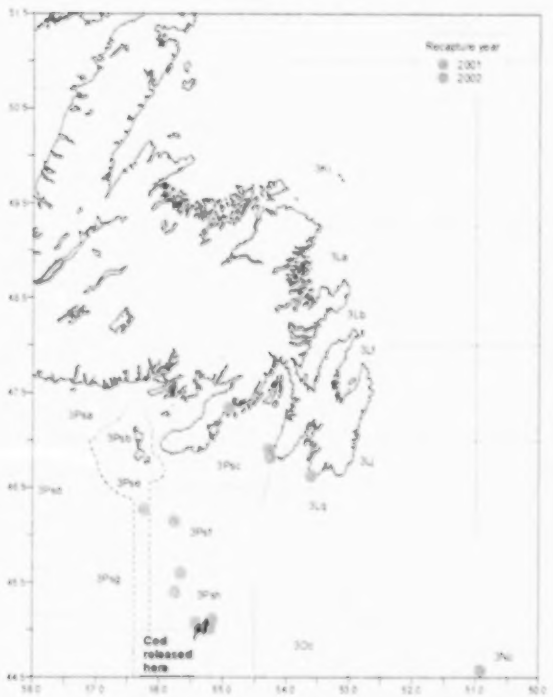
Reported recapture positions (dots) for cod tagged and released in Halibut Channel during 3-5 April 1998 (N=1842)



Reported recapture positions (dots) for cod tagged and released in Halibut Channel during 1-3 April 2000 (N=1044)

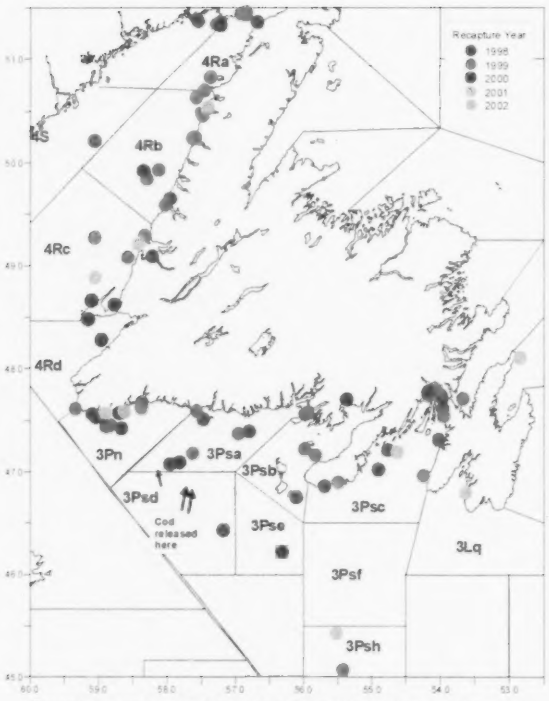


Reported recapture positions (dots) for cod tagged and released in Halibut Channel during 1-3 April 1999 (N=1808)

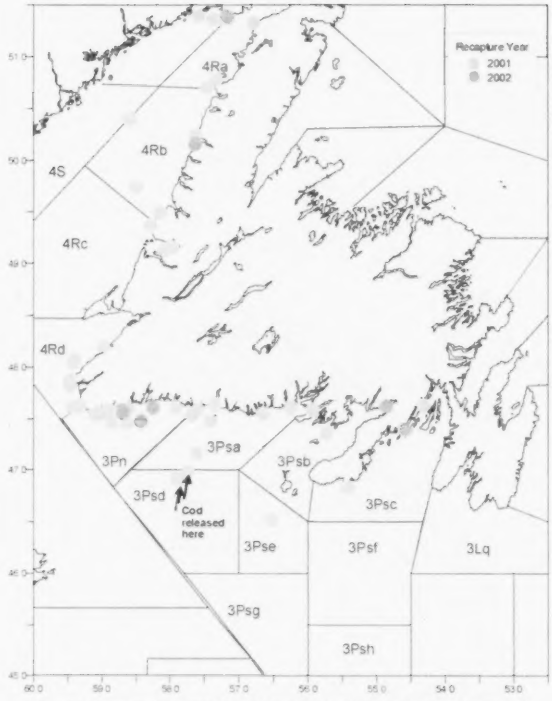


Reported recapture positions (dots) for cod tagged and released in Halibut Channel during 12-14 April 2001 (N=1144)

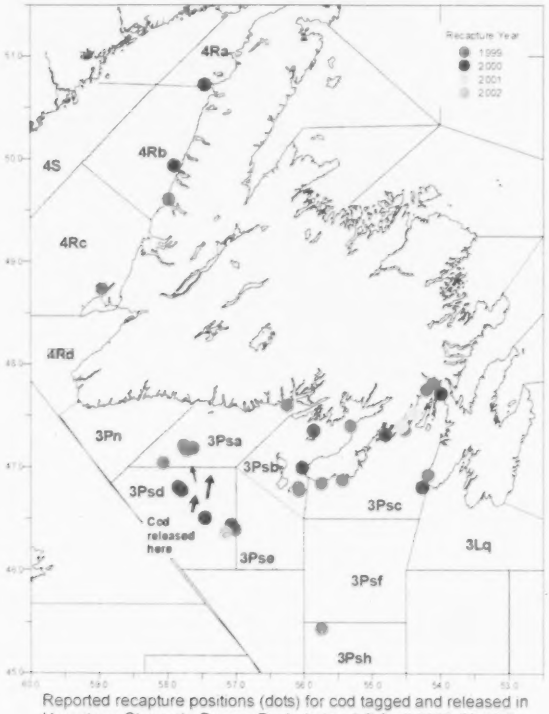
Fig. 3. Recapture locations for cod tagged and released in Halibut Channel 1998-2001.



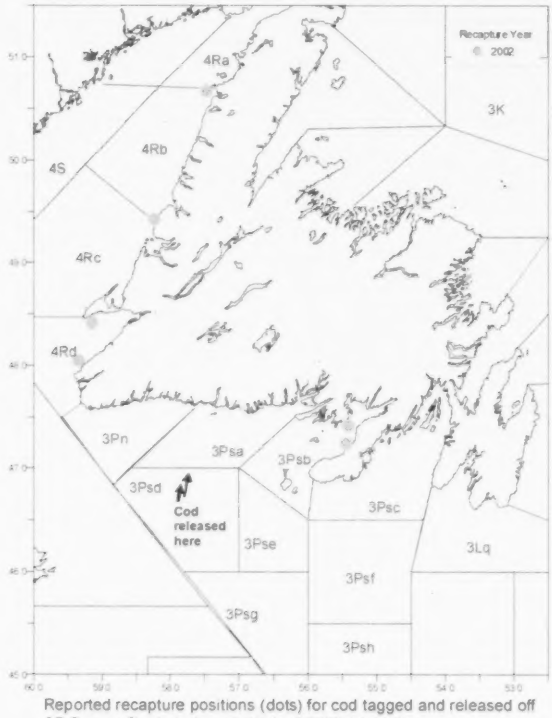
Reported recapture positions (dots) for cod tagged and released in Hermitage Channel - Burgeo Bank during 5-7 April 1998 (N=1352)



Reported recapture positions (dots) for cod tagged and released off Burgeo Bank-Hermitage Channel during 15-17 April 2001 (N=999)

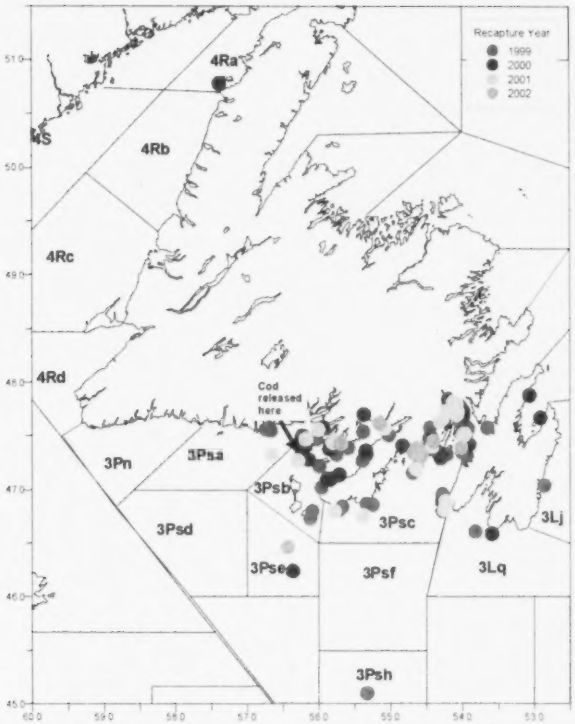


Reported recapture positions (dots) for cod tagged and released in Hermitage Channel - Burgeo Bank during 4-7 April 1999 (N=464)

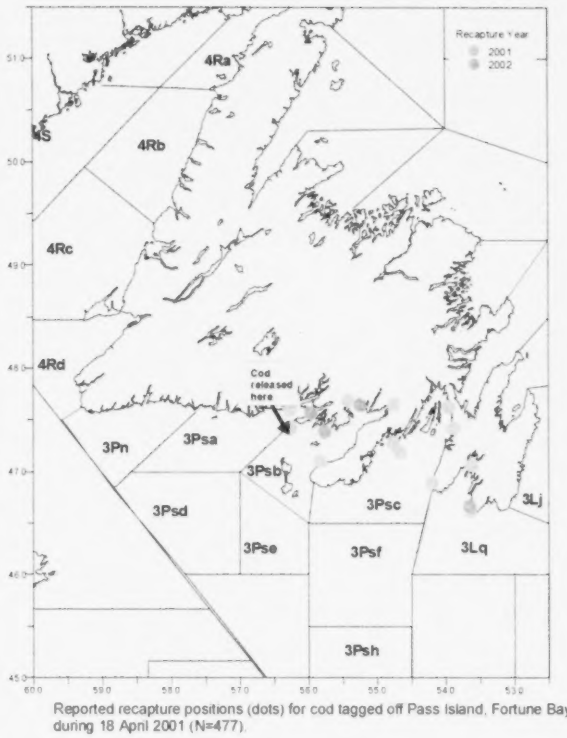


Reported recapture positions (dots) for cod tagged and released off SE Burgeo Bank during 14-15 April 2002 (N=963)

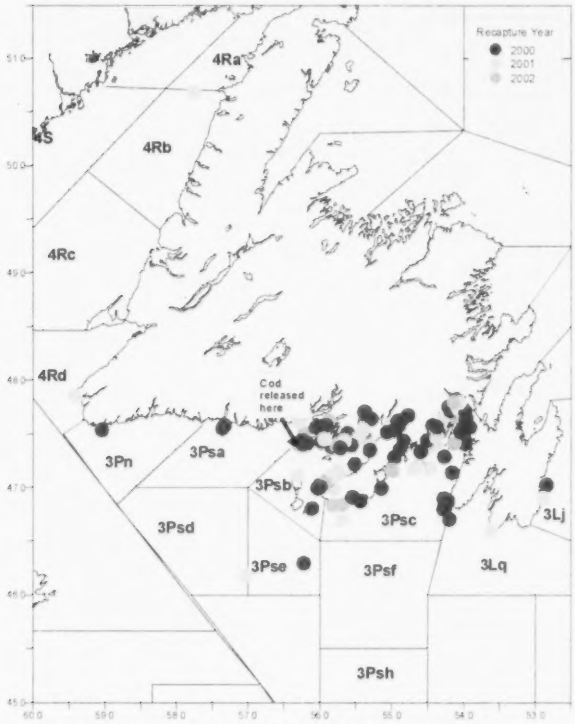
Fig. 4. Recapture locations for cod tagged and released off Burgeo Bank 1998-2002.



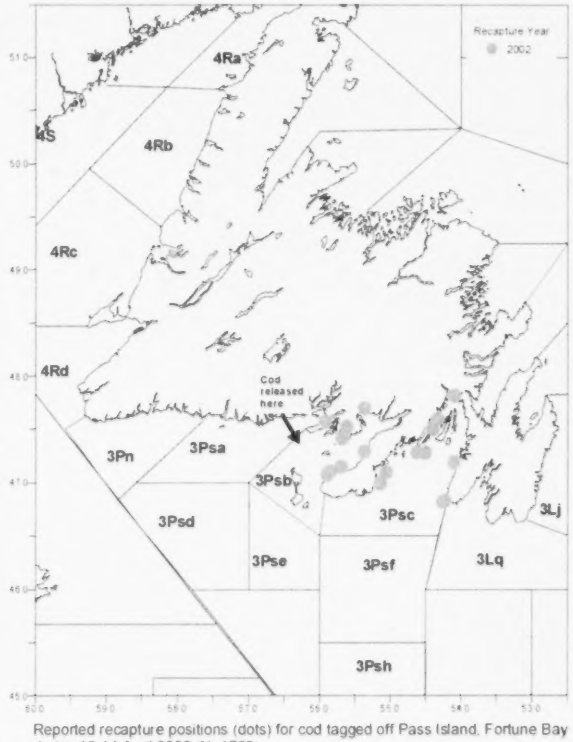
Reported recapture positions (dots) for cod tagged off Pass Island, Fortune Bay during 8 April 1999 (N=1293).



Reported recapture positions (dots) for cod tagged off Pass Island, Fortune Bay during 18 April 2001 (N=477).

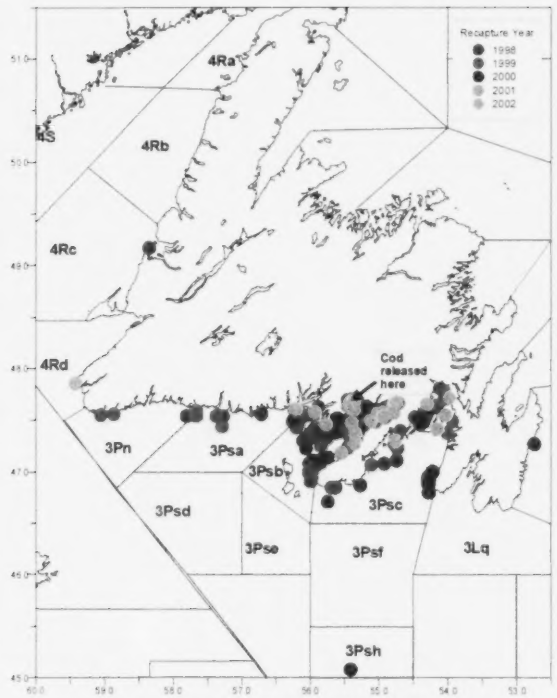


Reported recapture positions (dots) for cod tagged off Pass Island, Fortune Bay during 5-7 April 2000 (N=1665).

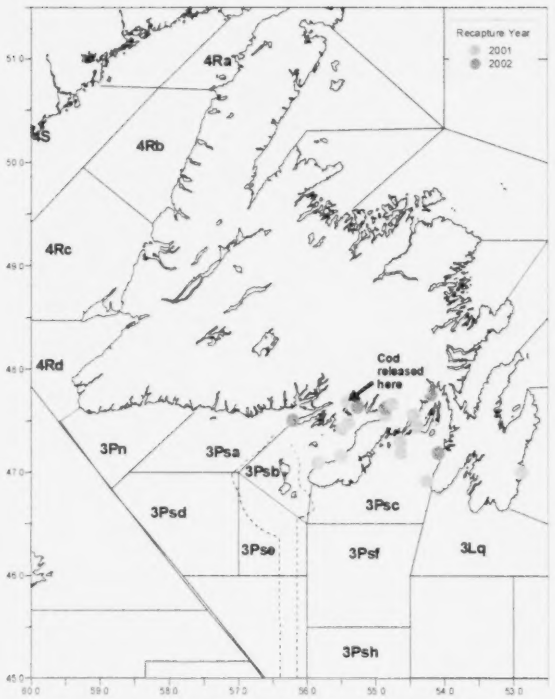


Reported recapture positions (dots) for cod tagged off Pass Island, Fortune Bay during 13-14 April 2002 (N=1792).

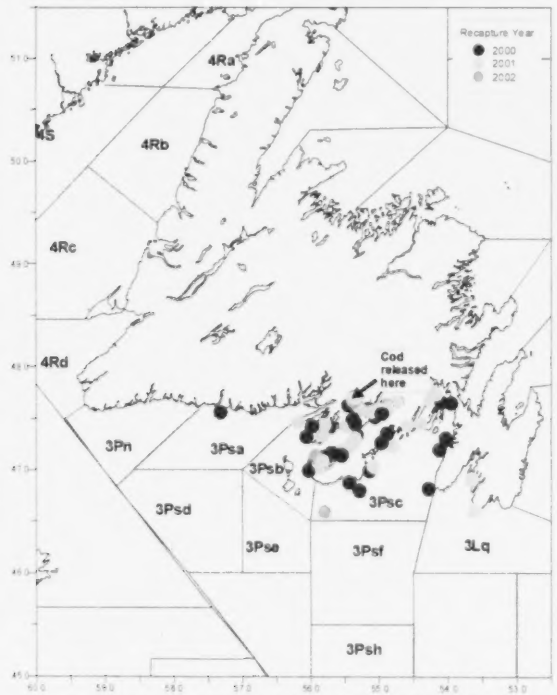
Fig. 5. Recapture locations for cod tagged and released off Pass Island, Fortune Bay during 1998 and 2000-2002.



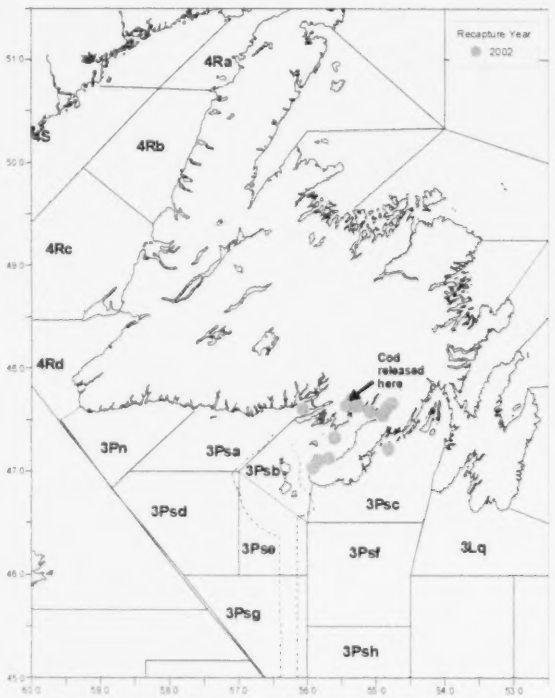
Reported recapture positions (dots) for cod tagged and released near Poole's Cove, Fortune Bay during 20-29 May 1998 (N=938).



Reported recapture positions (dots) for cod tagged and released off Poole's Cove, Fortune Bay during 9-11 January 2001 (N=588).

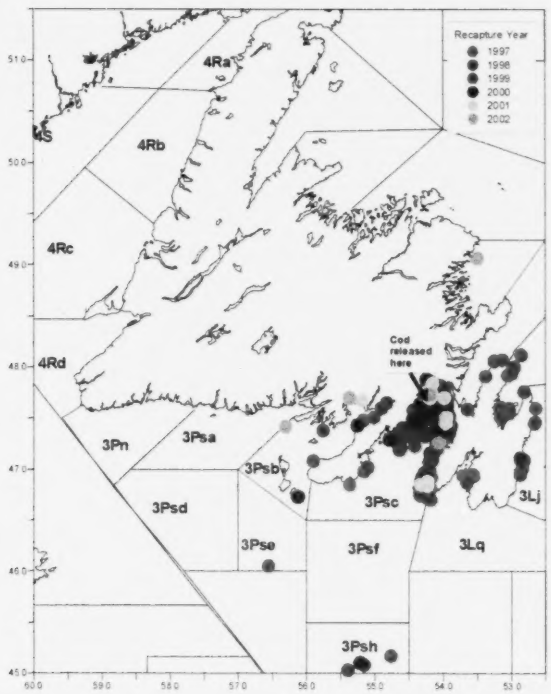


Reported recapture positions (dots) for cod tagged and released off Poole's Cove, Fortune Bay during 17-19 April 2000 (N=752).

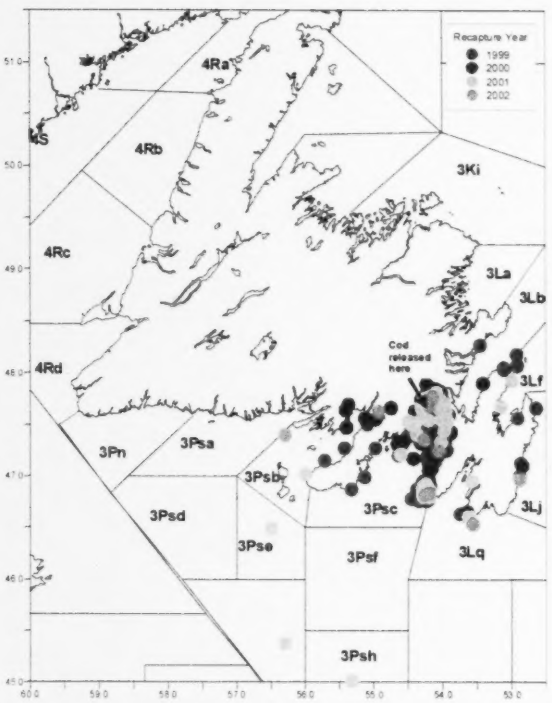


Reported recapture positions (dots) for cod tagged and released off Poole's Cove, Fortune Bay during 8-10 January 2002 (N=630).

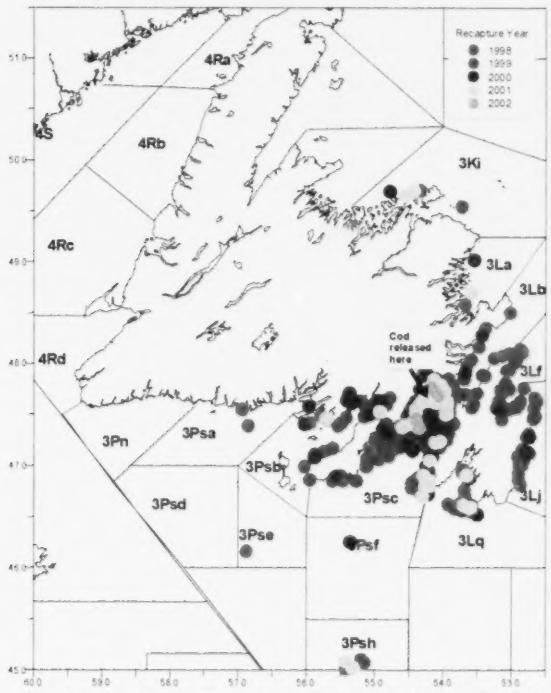
Fig. 6. Recapture locations for cod tagged and released off Poole's Cove, Fortune Bay during 1999-2002.



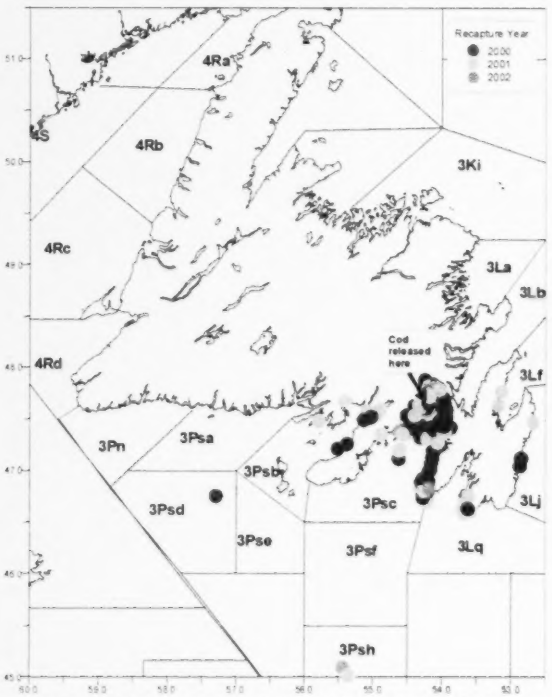
Reported recapture positions for cod tagged at the head of Placentia Bay during 9 April - 18 May 1997 (N=2779).



Reported recapture positions for cod tagged at the head of Placentia Bay during 29 April-7 May 1999 (N=2422)

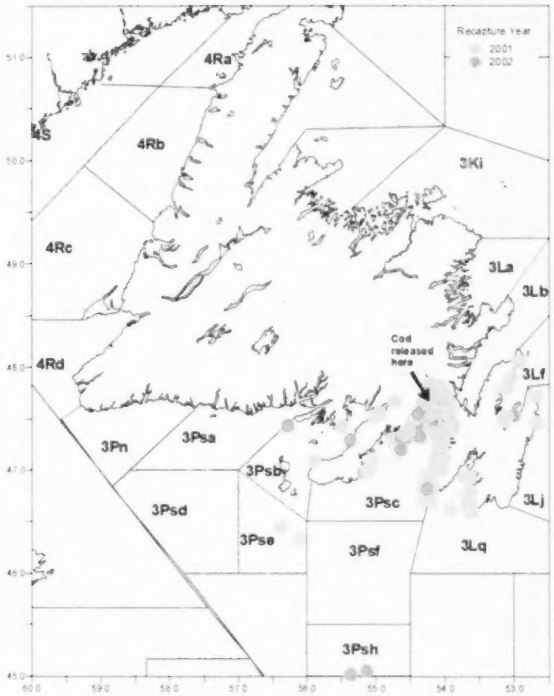


Reported recapture positions for cod tagged at the head of Placentia Bay during 22 April - 3 May 1998 (N=4322)

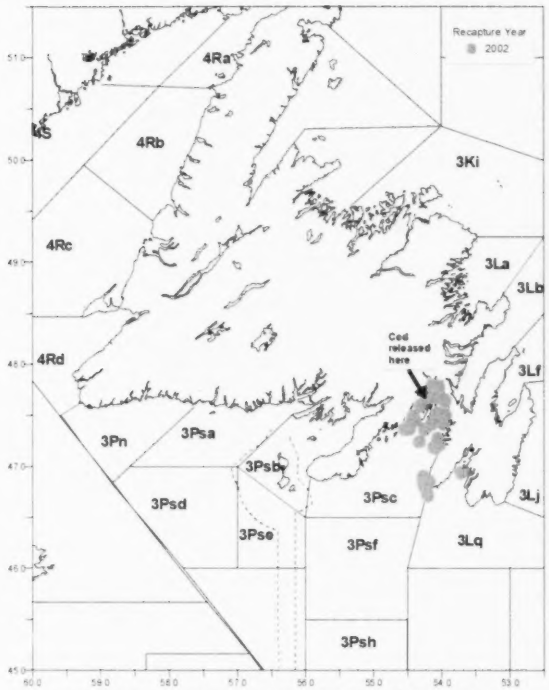


Reported recapture positions for cod tagged at the head of Placentia Bay during 26 April - 4 May 2000 (N=3112)

Fig. 7a. Recapture locations for cod tagged and released at the head of Placentia Bay during 1997-2000.

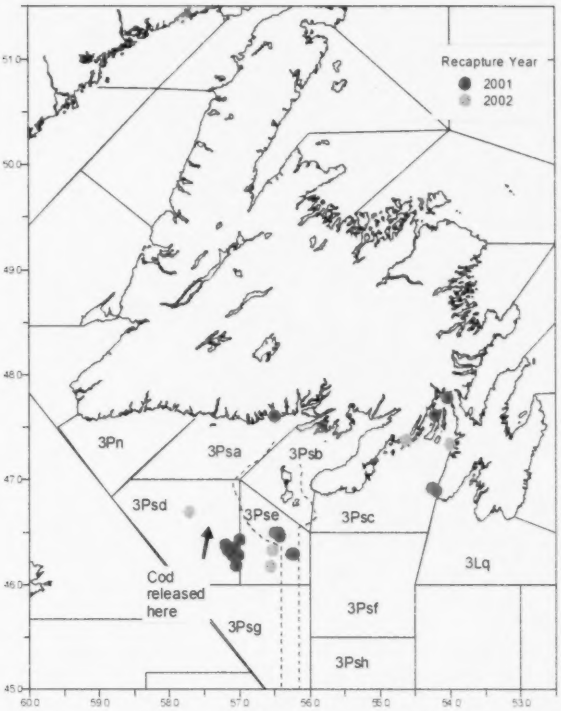


Reported recapture positions for cod tagged at the head of Placentia Bay during 28 April - 7 May 2001 (N=3976)



Reported recapture positions for cod tagged at the head of Placentia Bay during 27 April - 7 May 2002 (N=3231)

Fig. 7b. Recapture locations for cod tagged and released at the head of Placentia Bay during 2001-2002.



Reported recapture positions (dots) for cod tagged and released off northwestern St. Pierre Bank during 16-17 April 2001 (N=666).

Fig. 8. Recapture locations for cod tagged and released off northwestern St. Pierre Bank during 2001.